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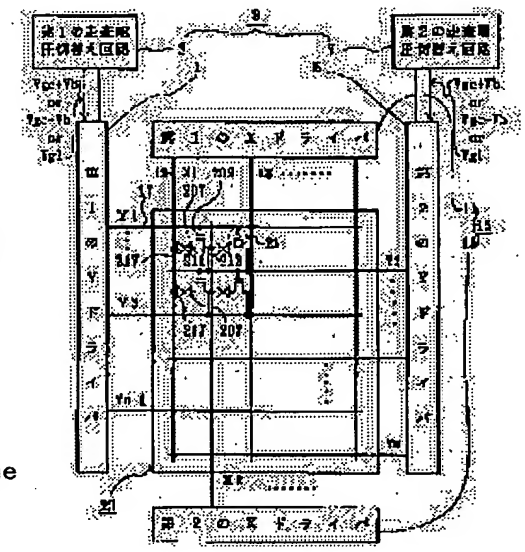
(54) LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PURPOSE: To obtain a liquid crystal display device with high yield at a manufacturing stage and with the excellent picture quality of a display image and with a high numerical aperture.

CONSTITUTION: By providing a scan voltage applying means 9 applying voltage Vgc which is the operation threshold value or below of a TFT element 21 and becomes the threshold value Vth or above of a liquid crystal composition superposing with a signal voltage Va to the scanning lines Y2 of the front or the rear stage of the scanning line Y1 connected to a gate 209 when the voltage Vgh of the operation threshold value Vth or above of the TFT element 21 is applied to the scanning line Y1 to which the gate 209 of the TFT element 21 is connected, and further applying the voltage Vgl of the voltage Vgc or below at a non scanning time, the same scanning line is shared as the connection wiring of the drain 213 of the front stage TFT element and the connection wiring of the gate 209 of the rear stage TFT element.



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CLAIMS

[Claim(s)]
[Claim 1] The opposite substrate with which the signal electrodes of the shape of two or more strip of paper were installed successively, and the pixel electrode which counters said signal electrode, is arranged and forms the pixel according to individual, The switching element array substrate which has the thin film transistor component connected to two or more scanning lines and the scanning line of the preceding paragraph of the scanning line with which the gate was connected to said scanning line, one side was connected to said pixel electrode among the source or a drain, and another side was connected to said gate, or the latter part, The liquid crystal constituent which is pinched between said signal electrodes and said pixel electrodes, and forms a liquid crystal cell, A signal-level impression means to impress a signal level to said signal electrode, When impressing the electrical potential difference more than the threshold of said thin film transistor component of operation to the scanning line to which said gate was connected To the scanning line of the preceding paragraph of the scanning line which was alike and was connected to said gate, or the latter part, are below the threshold of said thin film transistor component of operation, and an electrical potential difference which is overlapped on said signal level and turns into more than the threshold electrical potential difference of said liquid crystal cell is impressed. At the time of un-scanning [of the scanning line to which said gate was connected], to this scanning line, are below the threshold of said thin film transistor component of operation, and it superimposes on said signal level. The liquid crystal display characterized by providing a scan electrical-potential-difference impression means to impress an electrical potential difference which becomes below the threshold electrical potential difference of said liquid crystal cell.

[Translation done.]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to a liquid crystal display.
[0002]
[Description of the Prior Art] The liquid crystal display is used in various fields taking advantage of the

features, such as a thin shape, a light weight, and a low power. The liquid crystal display in which especially a multi-gradation display is possible attracts attention as a display device of OA equipment like television or a personal computer.

[0003] If shown in the liquid crystal display with which the formation of many pixels and highly minute-ization are demanded in recent years, it has come to attract attention all the more, because the display which does not have a contiguity inter-electrode cross talk to the display with much number of scanning lines is possible for the active-matrix mold liquid crystal display with which switching elements, such as a thin film transistor, were prepared in each pixel also in such a liquid crystal display.

[0004] This active-matrix mold liquid crystal display is explained based on drawing 5 .

[0005] Two or more scanning lines 501 and two or more signal lines 503 cross in the shape of a matrix, and are installed, and the insulator layer is usually inserted in the TFT substrate side so that the intersection may not short-circuit. And while TFT (below Thin Film Transistor;, TFT, and abbreviated name)505 is arranged near [intersection] each, the pixel electrode 507 connected to this is arranged.

[0006] Moreover, the counterelectrode 509 which counters the aforementioned pixel electrode 507 through liquid crystal is arranged at the opposite substrate side.

[0007] It connects with the Y driver 511 which is a scanning-line drive circuit, and a scan electrical potential difference is impressed to the aforementioned scanning line 501, it connects with the X driver 513 which is a signal-line drive circuit, and a signal level is impressed to a signal line 503. Moreover, the alternation electrical potential difference which potential reverses reference voltage or focusing on the reference voltage is impressed to the aforementioned counterelectrode 509. A control circuit 514 controls the Y driver 511 and the X driver 513.

[0008] And the gate 515 of TFT505 looks the source 517 and a drain 519 like [the aforementioned signal line 503] one side at a time in any of the aforementioned pixel electrode 507 respectively, and is connected to the aforementioned scanning line 501 again, respectively.

[0009] When a scan pulse is impressed to the aforementioned gate 515 of TFT505 through the scanning line 501, between the source 517 and a drain 519 will be in switch-on (low resistance condition), and it superimposes on the electrical potential difference to which a signal level is impressed to the pixel electrode 507, and is impressed from a counterelectrode 509, and is impressed by liquid crystal, and each liquid crystal cell is **(ed). In addition, the electrostatic capacity of a liquid crystal cell is set up so that time amount until the gate pulse of degree frame is usually impressed to the same scanning line, and the aforementioned signal level may be held with the electrostatic capacity of a liquid crystal cell. Or when the electrostatic capacity of a liquid crystal cell is insufficient, auxiliary capacity is installed in each of liquid crystal cells side by side.

[0010]

[Problem(s) to be Solved by the Invention] However, in the active-matrix mold liquid crystal display of such a configuration, although the active component of 1 million - 1 million numbers and the scanning line, and a signal line must be formed in a large area defect-free with the formation of many pixels and highly-minute-izing of the above screens, or enlargement, since it is complicated as mentioned above, a line defect, a point defect, and the defect of the poor insulation of the scanning line and a signal line specifically generate especially the structure of a TFT substrate. For this reason, there is a problem that the manufacture yield of a TFT substrate is not fully good, and that improvement is not easy, either.

[0011] Moreover, since the scanning line and a signal line cross in the shape of a matrix on the same TFT substrate and are arranged, there is a problem that the grace of the image which migration and a cross talk generate between the transfer signal (applied voltage), for example, distortion generates in a signal-level wave in a signal line, and is displayed between the scanning line and a signal line falls.

[0012] Moreover, since a pixel electrode can form the scanning line, a signal line, TFT, auxiliary capacity, etc. only in the range avoided and restricted, the ratio of the drive area of a liquid crystal display component and the so-called numerical aperture become low, and it has the problem that the improvement is not easy, either.

[0013] On the other hand, in a simple matrix type liquid crystal display, although a transparent electrode like ITO is used for a signal line and the scanning line such a transparent electrode by being markedly alike as compared with the signal line and the scanning line which consist of metals, such as general aluminum (aluminum) and Cr (chromium), with an active-matrix mold liquid crystal display, since electric resistance is high Descent of an electrical potential difference is large between the input edge of the scanning line or a signal line, and an end, generating of display unevenness or the display defect by being become blunt and generated in an applied-voltage wave occurs, and there is a problem that the formation of many pixels and highly-minute-izing of a screen, and enlargement are difficult.
[0014] It accomplished, in order that this invention might solve such a problem, and the purpose solves the above-mentioned problem, and the yield is good in a manufacture phase, and the image quality of a display image is good, and it is in offering a liquid crystal display also with a high numerical aperture.
[0015]
[Means for Solving the Problem] The opposite substrate with which, as for the liquid crystal display of this invention, the signal electrodes of the shape of two or more strip of paper were installed successively, The pixel electrode which counters said signal electrode, is arranged and forms the pixel according to individual, The switching element array substrate which has the thin film transistor component connected to two or more scanning lines and the scanning line of the preceding paragraph of the scanning line with which the gate was connected to said scanning line, one side was connected to said pixel electrode among the source or a drain, and another side was connected to said gate, or the latter part, The liquid crystal constituent which is pinched between said signal electrodes and said pixel electrodes, and forms a liquid crystal cell, A signal-level impression means to impress a signal level to said signal electrode, When impressing the electrical potential difference more than the threshold of said thin film transistor component of operation to the scanning line to which said gate was connected To the scanning line of the preceding paragraph of the scanning line which was alike and was connected to said gate, or the latter part, are below the threshold of said thin film transistor component of operation, and an electrical potential difference which is overlapped on said signal level and turns into more than the threshold electrical potential difference of said liquid crystal cell is impressed. It is characterized by providing a scan electrical-potential-difference impression means to impress [as opposed to / in the time of un-scanning / of the scanning line to which said gate was connected / this scanning line] an electrical potential difference which is below the threshold of said thin film transistor component of operation, and is overlapped on said signal level, and becomes below the threshold electrical potential difference of said liquid crystal cell. In addition, also signal level which consider as the electrical potential difference which impresses to the scanning line of the above [the aforementioned scan electrical-potential-difference impression means], and is impressed to a pixel electrode through a thin film transistor component, and the alternation electrical potential difference which a polarity reverses focusing on a reference potential for every frame period, and this is made to agree, and is impressed to a signal electrode It is good also as an alternation electrical potential difference which a polarity reverses focusing on a reference potential for every frame period.
[0016]
[Function] In the liquid crystal display of this invention, it is lost by not forming a signal line and the scanning line on the same TFT substrate that a signal line and the scanning line cross on a TFT substrate. Since the defect which is the intersection of the signal line and the scanning line like the conventional technique in which it connects too hastily is lost by this, improvement in the manufacture yield can be aimed at. Moreover, since the migration between the scanning line and a signal line, the distortion of a signal-level wave by the cross talk, etc. are cancelable, image quality of a display image can be made good.
[0017] Moreover, the electrical potential difference which carries out sequential impression to the scanning line When impressing the electrical potential difference more than the threshold of said thin film transistor component of operation to the scanning line to which the gate was connected As

opposed to the scanning line of the preceding paragraph of the scanning line which was alike and was connected to said gate, or the latter part below with the threshold of said thin film transistor component of operation by and the thing possessing a scan electrical-potential-difference impression means to impress an electrical potential difference which is overlapped on said signal level and becomes more than the threshold of said liquid crystal constituent It is the preceding paragraph and latter part about the same scanning line. Since it can use also [line / (or drain wire) / a gate line and / source] respectively, the thing of two TFT(s) for which a signal line like the conventional liquid crystal display is formed on a TFT substrate is omissible. Therefore, since the wrap need is also lost with a black mask etc. in the part by which a signal line is arranged, only the area equivalent to it can take a large pixel electrode, and its numerical aperture improves.

[0018] Moreover, the electrical potential difference which impresses to the scanning line of the above [the aforementioned scan electrical-potential-difference impression means], and is impressed to a pixel electrode through a thin film transistor component It considers as the alternation electrical potential difference which a polarity reverses focusing on a reference potential for every frame period. Since a signal level can be further made into low voltage if it is good also as an alternation electrical potential difference on which a polarity also reverses the signal level impressed to a signal electrode according to this focusing on a reference potential for every frame period and does in this way The poor display which originates in distortion of a signal-level wave etc. still more effectively, a cross talk, etc. are cancelable.

[0019]

[Example] Hereafter, based on a drawing, the example of the liquid crystal display of this invention is explained to a detail based on a drawing.

[0020] (Example 1) Drawing 1 is drawing showing the configuration of the liquid crystal display of the 1st example of this invention.

[0021] The 1st scan electrical-potential-difference change circuit 3 which connects the liquid crystal display of the 1st example to the 1st Y driver 1 and this, A scan electrical-potential-difference impression means 9 by which the principal part consists of the 2nd scan electrical-potential-difference change circuit 7 linked to the 2nd Y driver 5 and this, A signal-level impression means 15 by which the principal part consists of the 1st X driver 11 and the 2nd X driver 13, and the liquid crystal display component 23 are provided.

[0022] The opposite substrate 203 with which the signal electrodes 19 of the shape of two or more strip of paper which consists of a transparent electrode like ITO on a glass substrate 201 were installed successively as the liquid crystal display component 23 was shown in drawing 2 , The aforementioned signal electrode 19 is countered. It is arranged. The pixel according to individual The pixel electrode 207 to form Two or more scanning lines 17 The gate 209 It connects with the scanning line Y1 among the aforementioned scanning lines 17, and is the scanning line Y1 of the above [a drain 213]. The latter scanning line Y2 The TFT substrate 215 with which the thin film transistor component 21 by which connects and the source 211 is connected to the aforementioned pixel electrode 207 was formed on the glass substrate 205, The principal part consists of liquid crystal constituents 217 pinched between the aforementioned opposite substrate 203 and the TFT substrate 215.

[0023] The scan electrical-potential-difference impression means 9 is constituted by the 2nd scan electrical-potential-difference change circuit 7 linked to the 1st scan electrical-potential-difference change circuit 3 and the 2nd Y driver 5 which are connected to the 1st Y driver 1 and this as described above, and this. The 1st scan electrical-potential-difference change circuit 3 linked to the 1st Y driver 1 and this is the scanning line of odd lines, Y1 [for example,]. Scan electrical potential difference VY1 as shown in drawing 3 to the scanning line [like] It impresses. Moreover, the 2nd scan electrical-potential-difference change circuit 7 linked to the 2nd Y driver 5 and this is the scanning line of even lines, Y2 [for example,]. Scan electrical potential difference VY2 as shown in drawing 3 to the scanning line [like] It impresses.

[0024] The 1st scan electrical-potential-difference change circuit 3 and the 2nd scan electrical-potential-difference change circuit 7 are the scan electrical potential difference VY1 and VY2. Switching operation changed to each potential of Vgh, Vgc, and Vgl is performed.
[0025] the signal-level impression means 15 — said — as carried out, the principal part consists of the 1st X driver 11 and the 2nd X driver 13 — having — **** — the 1st X driver 11 — signal electrode X1 the signal electrode of an odd number train [like] — moreover, the 2nd X driver 13 — signal electrode X2 the signal electrode of an even number train [like] — the time of selection — signal level Va Moreover, at the time of un-choosing, a signal level Vgc is impressed, respectively.
[0026] As shown in drawing 3 , it is the scan electrical potential difference VY2. Scan electrical potential difference VY1 It receives. It is considering as the wave which delayed the phase by 1 scan pulse period. and these scan electrical potential differences VY1 and VY2 The electrical potential difference Vgh more than the threshold electrical potential difference Von of the TFT component 21 of operation, and signal level Va at the time of pixel selection it consists of an electrical potential difference Vgc which is overlapped and turns into more than the threshold electrical potential difference Vth of the liquid crystal cell of the liquid crystal display component 23, and an electrical potential difference Vgl which is overlapped on the signal level Vgc at the time of pixel un-choosing, and becomes below the threshold electrical potential difference Vth of the liquid crystal cell of the liquid crystal display component 23 — it is considering as the wave of three values.
[0027] Next, actuation of the liquid crystal display concerning this invention is explained.
[0028] the scanning line Y1 the gate 209 of the connected TFT component 21 — the 1st Y driver 1 to scan electrical potential difference VY1 It is impressed. As shown in drawing 3 , it is time amount t0 -t1. It is the scan electrical potential difference VY1 in between. Since potential is Vgc and Vgc is below the threshold electrical potential difference of the TFT component 21 of operation as mentioned above, the TFT component 21 will be in the condition of not flowing (OFF), and an electrical potential difference will not be impressed to the pixel electrode 207 connected to this TFT component 21. moreover, this time -- the scanning line Y1 The scanning line Y2 of the next step **** — scan electrical potential difference VY2 although impressed, it is shown in drawing 3 — as — scan electrical potential difference VY2 at this time since potential is Vgl and Vgl is also below the threshold electrical potential difference of the TFT component 21 of operation as mentioned above — the scanning line Y2 The TFT component of the next step which connects will also be in the condition of not flowing (OFF). And the aforementioned gate 209 is the scanning line Y1 at this time. The drain 213 of the connected TFT component 21 is also this scanning line Y2. Although it has connected, since the TFT component 21 is non-switch-on as mentioned above, an electrical potential difference is not impressed to the pixel electrode 207 connected to the source 211 of the TFT component 21, either.
[0029] The following time amount t1 -t2 At the example shown in a signal electrode 19 in between at drawing 3 , it is the selection pulse Va. It is impressed. This Va When superimposed on above Vgc, it is set as potential which serves as an electrical potential difference more than the threshold electrical potential difference Vth of the liquid crystal cell of the liquid crystal display component 23.
[0030] On the other hand, it is the scanning line Y1. In the gate of the connected TFT component 21, it is the 1st Y driver 1 to the scan electrical potential difference VY1. Although impressed, at this time, it is the scan electrical potential difference VY1. Since potential is Vgh, it will be in a flow (ON) condition between the drain 213 of the TFT component 21, and the source 211, and an electrical potential difference Vgc will be impressed to the pixel electrode 207 connected to the source 211. In the liquid crystal cell corresponding to the pixel electrode 207 this time, they are an electrical potential difference Vgc and an electrical potential difference Va. It superimposes, and it is impressed and that liquid crystal cell drives. Moreover, it is the scanning line Y2 at this time. The TFT component of the next step connected is the scan electrical potential difference VY2 impressed to that gate. Since potential is Vgc as mentioned above, it is in the condition of not flowing (off). Therefore, the same scanning line Y2 Even if it uses in common at the drain of the TFT component of the preceding paragraph, and the gate of the

TFT component of the next step, they are these at the time of 1 scan. What keeps two TFT components in coincidence as ON can be avoided, and the scanning line 17 can be chosen as line sequential.

[0031] the following time amount t2 -t4 between -- the aforementioned scanning line Y1 the time of un-scanning -- hitting -- the scanning line Y1 **** -- t2 -t3 an electrical potential difference Vgl impresses in between -- having -- t3 -t4 An electrical potential difference Vgc is impressed in between. t4 [and] from -- it becomes the scan period of degree frame.

[0032] Thus, it sets to the liquid crystal display concerning this invention. When impressing the electrical potential difference Vgh more than threshold Vth of the TFT component 21 of operation to the scanning line 17 to which the gate 209 of the TFT component 21 was connected As opposed to the scanning line of the preceding paragraph of the scanning line 17 connected to the aforementioned gate 209, or the latter part It is below the threshold of the TFT component 21 of ****** of operation, and is a signal level Va. By providing a scan electrical-potential-difference impression means 9 to impress the electrical potential difference Vgc which is overlapped and becomes more than threshold Vth of a liquid crystal constituent It is the source 211 (or it can be made to serve a double purpose as connection wiring of a drain 213, and connection wiring of the gate 209 of a latter TFT component, and a signal line is not formed on the TFT substrate 215 like the conventional liquid crystal display, but ** also becomes good.) of the TFT component of the preceding paragraph about the same scanning line 17.

[0033] Therefore, since the wrap need is also lost with a black mask etc. in the part by which a signal line is arranged, a large pixel electrode can be taken and a numerical aperture improves. Moreover, since a signal line (signal electrode 19) is not formed on the same TFT substrate 215 as the scanning line 17, it is lost that a signal line and the scanning line cross on a TFT substrate. Since defects, such as a short circuit of the intersection of the signal line and the scanning line like the conventional technique, are cancelable by this, improvement in the manufacture yield can be aimed at. Moreover, since the migration between the scanning line and a signal line, the distortion of a signal-level wave by the cross talk, etc. are cancelable, image quality of a display image can be made good.

[0034] (Example 2) The scan electrical potential difference VY1 which the scan electrical-potential-difference impression means 9 outputs to the scanning line in the liquid crystal display of the 1st above-mentioned example, and VY2 The configuration of the scan electrical-potential-difference impression means 9 was changed so that it might become a wave as shown in drawing 4 . Namely, VY1 of the 1st example t1 -t2 which can be set The potential Vgh of a between, and t2 -t3 It is supposed that the potential Vgl of a between etc. remains as it is. t0 -t1 The potential of a between, and t3 -t4 the potential of a between -- respectively -- a core [reference potential / Vgc] -- electrical potential difference Vb only -- electrical-potential-difference Vgc+Vb to reverse (alternation) And electrical-potential-difference Vgc-Vb ****** -- Signal level Va VX1 required for a liquid crystal drive, i.e., a signal level, They are electrical-potential-difference Vgc+Va and Vgc-Va at the time of selection. When superimposed Signal level Va from which the absolute value becomes more than the threshold electrical potential difference Vth of the liquid crystal display component 23 (liquid crystal cell) It enabled it to consider as low voltage more nearly further than the electrical potential difference of the 1st example. And other configurations were made into the same thing as the liquid crystal display of the 1st example. In addition, at this drawing 4 , it is t1 -t2. Between and t4 -t5 Between shows the voltage waveform in case the applicable pixel is chosen.

[0035] The liquid crystal display of the 2nd example which set up the scan electrical-potential-difference impression means 9 as mentioned above was able to cancel the poor display which originates in distortion of a signal-level wave etc. still more effectively, the cross talk, etc. rather than the liquid crystal display of the 1st example.

[0036]

[Effect of the Invention] As clearly shown by the above detailed explanation, the liquid crystal display of this invention is a liquid crystal display with which the yield improved [that it is possible] that the

numerical aperture of the liquid crystal display component is high good, and the image quality of a display image makes the brightness of a screen high efficiently in the manufacture phase.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing the configuration of the liquid crystal display of the 1st example concerning this invention.
[Drawing 2] Drawing showing typically the structure of the liquid crystal display component part of the liquid crystal display concerning this invention.
[Drawing 3] The wave form chart showing the 1st scan electrical potential difference and signal level of a liquid crystal display of an example concerning this invention.
[Drawing 4] The wave form chart showing the 2nd scan electrical potential difference and signal level of a liquid crystal display of an example concerning this invention.
[Drawing 5] Drawing showing the configuration of the conventional active-matrix mold liquid crystal display.
[Description of Notations]
1 — 1st Y driver, 3 — The 1st scan electrical-potential-difference change circuit, 5 — 2nd Y driver, 7 — The 2nd scan electrical-potential-difference change circuit, 9 — Scan electrical-potential-difference impression means 9 and 11 — 1st X driver, 13 [— A signal electrode, 21 / — A TFT component, 23 / — A liquid crystal display component, 207 / — A pixel electrode, 209 / — The gate, 211 / — The source, 213 / — Drain] — 2nd X driver, 15 — A signal-level impression means, 17 — The scanning line, 19

[Translation done.]

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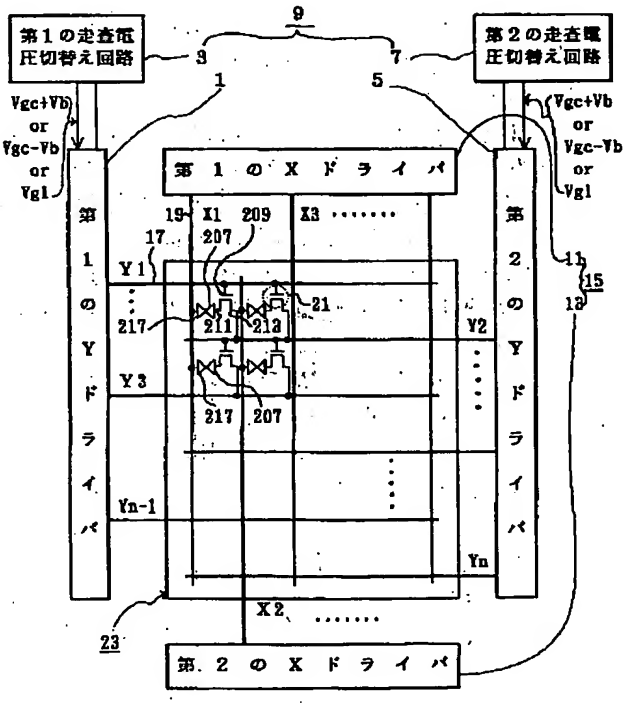
(54)【発明の名称】　液晶表示装置

(57)【要約】

【目的】　製造段階で歩留まりが良く、また表示画像の画質が良好で、開口率も高い液晶表示装置を提供する。

【構成】　ＴＦＴ素子２１のゲート２０９が接続された走査線Ｙ1 に対してＴＦＴ素子２１の動作しきい値Ｖth以上の電圧Ｖghを印加するときに、前記のゲート２０９に接続された走査線Ｙ1 の前段または後段の走査線Ｙ2に対しては前記のＴＦＴ素子２１の動作しきい値以下でかつ信号電圧Ｖa と重畳して液晶組成物のしきい値Ｖth以上となるような電圧Ｖgcを印加し、また非走査時には前記の電圧Ｖgc以下の電圧Ｖglを印加する走査電圧印加手段９を具備することで、同一走査線をその前段のＴＦＴ素子のドレイン２１３の接続配線および後段のＴＦＴ素子のゲート２０９の接続配線として兼用することができる。



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【特許請求の範囲】

【請求項１】　複数の短冊状の信号電極が列設された対向基板と、

前記信号電極に対向して配置され個別の画素を形成する画素電極と、複数の走査線と、ゲートが前記走査線に接続されソースまたはドレインのうち一方が前記画素電極に接続され他方が前記ゲートに接続された走査線の前段または後段の走査線に接続された薄膜トランジスタ素子とを有するスイッチング素子アレイ基板と、

前記信号電極と前記画素電極との間に挟持されて液晶セルを形成する液晶組成物と、

前記信号電極に信号電圧を印加する信号電圧印加手段と、

前記ゲートが接続された走査線に対して前記薄膜トランジスタ素子の動作しきい値以上の電圧を印加するときに前記ゲートに接続された走査線の前段または後段の走査線に対して前記薄膜トランジスタ素子の動作しきい値以下でかつ前記信号電圧と重畳して前記液晶セルのしきい値電圧以上となるような電圧を印加し、前記ゲートが接続された走査線の非走査時には該走査線に対して前記薄膜トランジスタ素子の動作しきい値以下でかつ前記信号電圧と重畳して前記液晶セルのしきい値電圧以下となるような電圧を印加する走査電圧印加手段とを具備することを特徴とする液晶表示装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は液晶表示装置に関する。

【０００２】

【従来の技術】液晶表示装置は、薄型、軽量、低消費電力等の特長を活かして種々の分野で利用されている。特に多階調表示が可能な液晶表示装置はテレビやパーソナルコンピュータのようなＯＡ機器のディスプレイデバイスとして注目されている。

【０００３】そのような液晶表示装置のなかでも、各画素に薄膜トランジスタ等のスイッチング素子が設けられたアクティブマトリックス型液晶表示装置は、走査線数の多い表示に対しても隣接電極間でのクロストークのない表示が可能であることから、近年、多画素化や高精細化の要求される液晶表示装置にあっては、ますます注目されるようになってきた。

【０００４】このアクティブマトリックス型液晶表示装置を、図５に基づいて説明する。

【０００５】ＴＦＴ基板側には、複数の走査線５０１と複数の信号線５０３がマトリクス状に交差して設置され、その交差部が短絡しないように通常は絶縁膜が介挿されている。そして各交差部近傍にはＴＦＴ（Thin Film Transistor；以下、ＴＦＴと略称）５０５が配設されるとともに、これに接続される画素電極５０７が配設されている。

【０００６】また対向基板側には、前記の画素電極５０

2

７に液晶を介して対向する対向電極５０９が配置されている。

【０００７】前記の走査線５０１は走査線駆動回路であるＹドライバ５１１に接続されて走査電圧を印加され、信号線５０３は信号線駆動回路であるＸドライバ５１３に接続されて信号電圧を印加される。また前記の対向電極５０９には基準電圧またはその基準電圧を中心として電位が反転する交番電圧が印加される。制御回路５１４はＹドライバ５１１およびＸドライバ５１３を制御する。

【０００８】そしてＴＦＴ５０５のゲート５１５は前記の走査線５０１に、またソース５１７とドレイン５１９は各々前記の信号線５０３と前記の画素電極５０７のいずれか一方ずつにそれぞれ接続されている。

【０００９】走査線５０１を介して走査パルスが前記のＴＦＴ５０５のゲート５１５に印加されるとそのソース５１７およびドレイン５１９間が導通状態（低抵抗状態）となって信号電圧が画素電極５０７に印加され、対向電極５０９から印加される電圧と重畳して液晶に印加され、各液晶セルが動される。なお通常、同一の走査線に次フレームのゲートパルスが印加されるまでの時間、前記の信号電圧が液晶セルの静電容量により保持されるように液晶セルの静電容量が設定されている。あるいは液晶セルの静電容量が不足の場合には、補助容量を液晶セルの一つ一つに並設する。

【００１０】

【発明が解決しようとする課題】しかしながら、このような構成のアクティブマトリックス型液晶表示装置においては、前述のような画面の多画素化や高精細化や大型化に伴なって、大面積に百万～数百万個ものアクティブ素子および走査線と信号線とを無欠陥に形成しなければならないが、特にＴＦＴ基板の構造は上記のように複雑であるために、線欠陥、点欠陥、具体的には例えば走査線と信号線との絶縁不良といった欠陥が発生する。このため、ＴＦＴ基板の製造歩留まりが十分に良好でなくその向上も容易ではないという問題がある。

【００１１】また、走査線と信号線とが同一ＴＦＴ基板上にマトリックス状に交差して配置されているので、走査線と信号線との間で、その伝達信号（印加電圧）間にマイグレーションやクロストークが発生し、例えば信号線においては信号電圧波形に歪みが発生し、表示する画像の品位が低下するという問題がある。

【００１２】また、画素電極は、走査線、信号線、ＴＦＴ、補助容量などを避けて限られた範囲にしか形成できないため、液晶表示素子の駆動面積の比率、いわゆる開口率が低くなり、その改善も容易ではないという問題がある。

【００１３】一方、単純マトリックス型液晶表示装置においては、信号線にも走査線にもＩＴＯのような透明電極を用いているが、このような透明電極は、アクティブ

3

マトリックス型液晶表示装置で一般的なＡｌ（アルミニウム）やＣｒ（クロム）などの金属からなる信号線や走査線と比較して格段に電気抵抗が高いので、走査線や信号線の入力端部と末端部との間で電圧の降下が大きく、表示むらの発生、あるいは印加電圧波形に鈍り生じることによる表示欠陥などが発生し、画面の多画素化や高精細化や大型化が困難であるという問題がある。

【００１４】本発明は、このような問題を解決するために成されたもので、その目的は、上記の問題を解決して、製造段階で歩留まりが良く、また表示画像の画質が良好で、開口率も高い液晶表示装置を提供することにある。

【００１５】

【課題を解決するための手段】本発明の液晶表示装置は、複数の短冊状の信号電極が列設された対向基板と、前記信号電極に対向して配置され個別の画素を形成する画素電極と、複数の走査線と、ゲートが前記走査線に接続されソースまたはドレインのうち一方が前記画素電極に接続され他方が前記ゲートに接続された走査線の前段または後段の走査線に接続された薄膜トランジスタ素子とを有するスイッチング素子アレイ基板と、前記信号電極と前記画素電極との間に挟持されて液晶セルを形成する液晶組成物と、前記信号電極に信号電圧を印加する信号電圧印加手段と、前記ゲートが接続された走査線に対して前記薄膜トランジスタ素子の動作しきい値以上の電圧を印加するときに前記ゲートに接続された走査線の前段または後段の走査線に対して前記薄膜トランジスタ素子の動作しきい値以下でかつ前記信号電圧と重畳して前記液晶セルのしきい値電圧以上となるような電圧を印加し、前記ゲートが接続された走査線の非走査時には該走査線に対して前記薄膜トランジスタ素子の動作しきい値以下でかつ前記信号電圧と重畳して前記液晶セルのしきい値電圧以下となるような電圧を印加する走査電圧印加手段とを具備することを特徴としている。なお、前記の走査電圧印加手段が前記の走査線に印加し薄膜トランジスタ素子を介して画素電極に印加する電圧は、１フレーム周期ごとに基準電位を中心としで極性が反転する交番電圧とし、またこれに合致させて信号電極に印加する信号電圧も１フレーム周期ごとに基準電位を中心として極性が反転する交番電圧としてもよい。

【００１６】

【作用】本発明の液晶表示装置においては、信号線と走査線とを同一ＴＦＴ基板上には形成しないことにより、信号線と走査線とがＴＦＴ基板上で交差することがなくなる。これにより、従来技術のような信号線と走査線との交差部の短絡するといった欠陥等がなくなるので、製造歩留まりの向上を図ることができる。また、走査線と信号線の間でのマイグレーションやクロストークによる信号電圧波形の歪みなどを解消することができるので、表示画像の画質を良好なものとすることができる。

4

【００１７】また、走査線に順次印加する電圧を、ゲートが接続された走査線に対して前記薄膜トランジスタ素子の動作しきい値以上の電圧を印加するときに前記ゲートに接続された走査線の前段または後段の走査線に対して前記薄膜トランジスタ素子の動作しきい値以下でかつ前記信号電圧と重畳して前記液晶組成物のしきい値以上となるような電圧を印加する走査電圧印加手段を具備することで、同一走査線をその前段と後段の２つのＴＦＴの各々ゲート線とソース線（またはドレイン線）とに兼用することができるので、従来の液晶表示装置のような信号線をＴＦＴ基板上に形成することを省略することができる。したがって信号線の配置される部分をブラックマスク等で覆う必要もなくなるので、それに相当する面積だけ画素電極を大きくとることができ、開口率が向上する。

【００１８】また、前記の走査電圧印加手段が前記の走査線に印加し薄膜トランジスタ素子を介して画素電極に印加する電圧は、1フレーム周期ごとに基準電位を中心として極性が反転する交番電圧とし、これに合わせて信号電極に印加する信号電圧も1フレーム周期ごとに基準電位を中心として極性が反転する交番電圧としてもよく、このようにすれば信号電圧をさらに低電位とすることができるので、さらに効果的に信号電圧波形の歪みなどに起因する表示不良や、クロストークなどを解消することができる。

【００１９】

【実施例】以下、図面に基づいて本発明の液晶表示装置の実施例を図面に基づいて詳細に説明する。

【００２０】（実施例１）図１は、本発明の第１の実施例の液晶表示装置の構成を示す図である。

【００２１】第１の実施例の液晶表示装置は、第１のＹドライバ１とこれに接続する第１の走査電圧切替え回路３と、第２のＹドライバ５とこれに接続する第２の走査電圧切替え回路７とからその主要部が構成される走査電圧印加手段９と、第１のＸドライバ１１および第２のＸドライバ１３とからその主要部が構成される信号電圧印加手段１５と、液晶表示素子２３とを具備している。

【００２２】液晶表示素子２３は、図２に示すように、ガラス基板２０１上にＩＴＯのような透明電極からなる複数の短冊状の信号電極１９が列設された対向基板２０３と、前記の信号電極１９に対向して配置され個別の画素を形成する画素電極２０７と複数の走査線１７とゲート２０９が前記の走査線１７のうち例えば走査線Ｙ1に接続されドレイン２１３が前記の走査線Ｙ1 の後段の走査線Ｙ2 に接続されソース２１１が前記の画素電極２０７に接続される薄膜トランジスタ素子２１とがガラス基板２０５上に形成されたＴＦＴ基板２１５と、前記の対向基板２０３とＴＦＴ基板２１５との間に挟持される液晶組成物２１７とから、その主要部が構成されている。

【００２３】走査電圧印加手段９は、前記したように第

１のＹドライバ１とこれに接続する第１の走査電圧切替え回路３と第２のＹドライバ５とこれに接続する第２の走査電圧切替え回路７とによって構成されており、第１のＹドライバ１とこれに接続する第１の走査電圧切替え回路３は、奇数行の走査線、例えばY1 のような走査線に対して、図３に示すような走査電圧ＶＹ1 を印加する。また第２のＹドライバ５とこれに接続する第２の走査電圧切替え回路７は、偶数行の走査線、例えばY2 のような走査線に対して、図３に示すような走査電圧ＶＹ2 を印加する。

【００２４】第１の走査電圧切替え回路３および第２の走査電圧切替え回路７は、走査電圧ＶＹ1 、ＶＹ2 をＶgh、Ｖgc、Ｖglの各電位に切替えるスイッチング動作を行なう。

【００２５】信号電圧印加手段１５は、前記したように第１のＸドライバ１１および第２のＸドライバ１３からその主要部が構成されており、第１のＸドライバ１１は信号電極X1 のような奇数列の信号電極に、また第２のＸドライバ１３は信号電極X2 のような偶数列の信号電極に選択時には信号電圧Ｖa を、また非選択時には信号電圧Ｖgcを、それぞれ印加する。

【００２６】図３に示すように、走査電圧ＶＹ2 は走査電圧ＶY1 に対して 1走査パルス時間分だけ位相を遅らせた波形としている。そしてこれらの走査電圧ＶＹ1 、ＶＹ2 は、ＴＦＴ素子２１の動作しきい値電圧Ｖon以上の電圧Ｖghと、画素選択時の信号電圧Ｖa と重畳して液晶表示素子２３の液晶セルのしきい値電圧Ｖth以上となるような電圧Ｖgcと、画素非選択時の信号電圧Ｖgcと重畳して液晶表示素子２３の液晶セルのしきい値電圧Ｖth以下となるような電圧Ｖglとからなる、 3値の波形としている。

【００２７】次に、本発明に係る液晶表示装置の動作を説明する。

【００２８】走査線Y1 に接続されたＴＦＴ素子２１のゲート２０９には、第１のＹドライバ１から走査電圧ＶY1 が印加される。図３に示すように、時間ｔ0 ～ｔ1 間は走査電圧ＶＹ1 の電位はＶgcであり、Ｖgcは前述のようにＴＦＴ素子２１の動作しきい値電圧以下であるので、ＴＦＴ素子２１は非導通（オフ）状態となり、このＴＦＴ素子２１に接続されている画素電極２０７には電圧が印加されない。またこのとき走査線Y1 の次段の走査線Y2 には走査電圧ＶＹ2 が印加されるが、図３に示すようにこのときの走査電圧ＶＹ2 の電位はＶglであり、Ｖglも前述のようにＴＦＴ素子２１の動作しきい値電圧以下であるので、走査線Y2 に接続する次段のＴＦＴ素子も非導通（オフ）状態となる。そしてこのとき、前記のゲート２０９が走査線Y1 に接続されたＴＦＴ素子２１のドレイン２１３もこの走査線Y2 に接続しているが、前述したようにＴＦＴ素子２１は非導通状態なので、ＴＦＴ素子２１のソース２１１に接続された画素電極２０７にも電圧は印加されない。

【００２９】次の時間ｔ1 ～ｔ2 間では、信号電極１９には図３に示す例では選択パルスＶa が印加される。このＶa は、前記のＶgcと重畳したときに液晶表示素子２３の液晶セルのしきい値電圧Ｖth以上の電圧となるような電位に設定されている。

【００３０】一方、走査線Y1 に接続されたＴＦＴ素子２１のゲートには、第１のＹドライバ１から走査電圧ＶＹ1 が印加されるが、このときには走査電圧ＶＹ1 の電位はＶghであるので、ＴＦＴ素子２１のドレイン２１３とソース２１１との間は導通（オン）状態となり、ソース２１１に接続された画素電極２０７に対して電圧Ｖgcが印加される。このとき画素電極２０７に対応する液晶セルには電圧Ｖgcと電圧Ｖa とが重畳して印加され、その液晶セルが駆動される。またこのとき、走査線Y2 に接続されている次段のＴＦＴ素子は、そのゲートに印加される走査電圧ＶＹ2 の電位が前記のようにＶgcであるので、非導通（オフ）状態となっている。したがって、同一の走査線Y2 を前段のＴＦＴ素子のドレインと次段のＴＦＴ素子のゲートとで共用しても、一走査時にこれら 2つのＴＦＴ素子を同時にオンとしてしまうようなことを避けることができ、走査線１７を線順次に選択してゆくことができる。

【００３１】次の時間ｔ2 ～ｔ4 の間は、前記の走査線Y1 の非走査時にあたり、走査線Y1 にはｔ2 ～ｔ3 間は電圧Ｖglが印加され、ｔ3 ～ｔ4 間は電圧Ｖgcが印加される。そしてｔ4 から次フレームの走査周期となる。

【００３２】このように、本発明に係る液晶表示装置においては、ＴＦＴ素子２１のゲート２０９が接続された走査線１７に対してＴＦＴ素子２１の動作しきい値Ｖth以上の電圧Ｖghを印加するときに、前記のゲート２０９に接続された走査線１７の前段または後段の走査線に対しては前記のＴＦＴ素子２１の動作しきい値以下でかつ信号電圧Ｖa と重畳して液晶組成物のしきい値Ｖth以上となるような電圧Ｖgcを印加する走査電圧印加手段９を具備することによって、同一走査線１７をその前段のＴＦＴ素子のソース２１１（またはドレイン２１３の接続配線および後段のＴＦＴ素子のゲート２０９の接続配線として兼用することができ、従来の液晶表示装置のようにはＴＦＴ基板２１５上に信号線を形成せずともよくなる。

【００３３】したがって信号線の配置される部分をブラックマスク等で覆う必要もなくなるので、画素電極を大きくとることができ、開口率が向上する。また信号線（信号電極１９）を走査線１７と同じＴＦＴ基板２１５上には形成しないので、信号線と走査線とがＴＦＴ基板上で交差することがなくなる。これにより、従来技術のような信号線と走査線との交差部の短絡等の欠陥を解消することができるので、製造歩留まりの向上を図ることができる。また、走査線と信号線の間でのマイグレーシ

ョンやクロストークによる信号電圧波形の歪みなどを解消することができるので、表示画像の画質を良好なものとすることができる。

【００３４】（実施例２）上記の第１の実施例の液晶表示装置において、走査電圧印加手段９が走査線に対して出力する走査電圧ＶＹ１、ＶＹ２を、図４に示すような波形となるように走査電圧印加手段９の構成を変更した。すなわち、第１の実施例のＶＹ１におけるｔ１～ｔ２間の電位Ｖghおよびｔ２～ｔ３間の電位Ｖgl等はそのままとし、ｔ０～ｔ１間の電位およびｔ３～ｔ４間の電位を、それぞれ基準電位Ｖgcを中心に電圧Ｖb だけ反転（交番）する電圧Ｖgc＋Ｖb および電圧Ｖgc－Ｖb として、液晶駆動に必要な信号電圧Ｖa、すなわち信号電圧ＶＸ１の選択時電圧Ｖgc＋ＶaおよびＶgc－Ｖa と重畳したときに、その絶対値が液晶表示素子２３（の液晶セル）のしきい値電圧Ｖth以上となるような信号電圧Ｖaを、第１の実施例の電圧よりもさらに低電位とすることができるようにした。そしてその他の構成は第１の実施例の液晶表示装置と同様のものとした。なお、この図４ではｔ１～ｔ２間およびｔ４～ｔ５間ともに該当画素が選択されている場合の電圧波形を示している。

【００３５】上述のように走査電圧印加手段９を設定した第２の実施例の液晶表示装置は、第１の実施例の液晶表示装置よりも、さらに効果的に信号電圧波形の歪みなどに起因する表示不良や、クロストークなどを解消することができた。

【００３６】

【発明の効果】以上の詳細な説明で明示したように、本発明の液晶表示装置は、製造段階で歩留まりが良く、また表示画像の画質が良好で、かつその液晶表示素子の開口率が高く画面の輝度を効率的に高くすることを可能とした液晶表示装置である。

【図面の簡単な説明】

【図１】本発明に係る第１の実施例の液晶表示装置の構成を示す図。

【図２】本発明に係る液晶表示装置の液晶表示素子部分の構造を模式的に示す図。

【図３】本発明に係る第１の実施例の液晶表示装置の走査電圧および信号電圧を示す波形図。

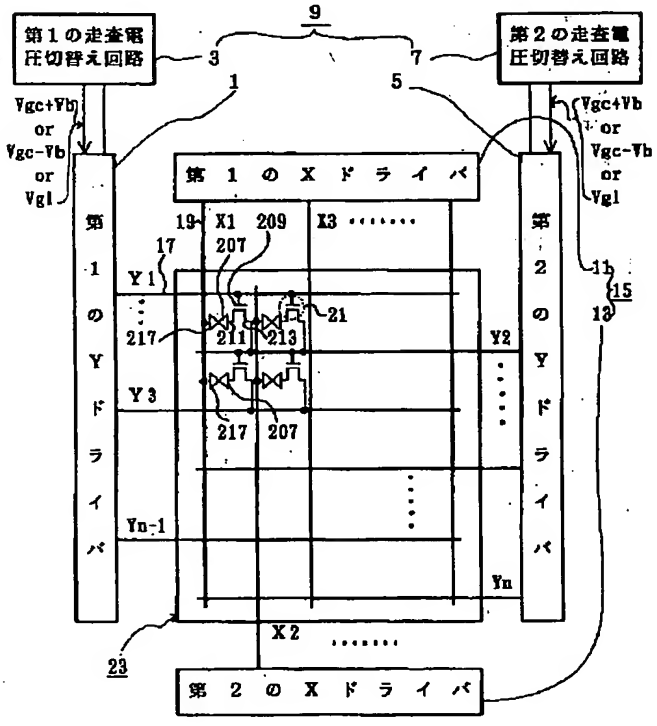
【図４】本発明に係る第２の実施例の液晶表示装置の走査電圧および信号電圧を示す波形図。

【図５】従来のアクティブマトリックス型液晶表示装置の構成を示す図。

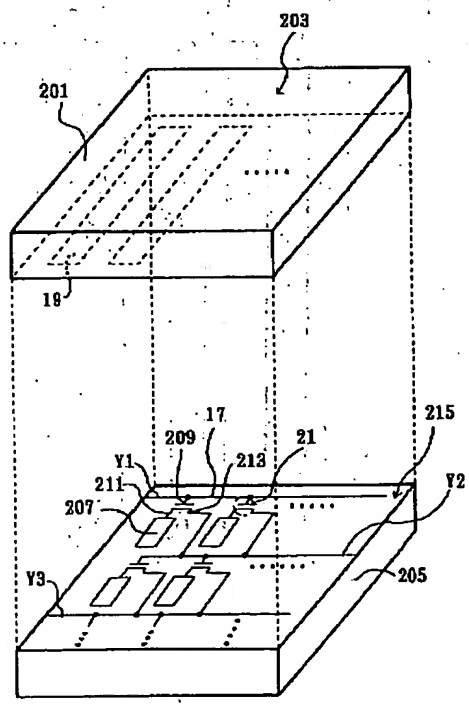
【符号の説明】

１…第１のＹドライバ、３…第１の走査電圧切替え回路、５…第２のＹドライバ、７…第２の走査電圧切替え回路、９…走査電圧印加手段９、１１…第１のＸドライバ、１３…第２のＸドライバ、１５…信号電圧印加手段、１７…走査線、１９…信号電極、２１…ＴＦＴ素子、２３…液晶表示素子、２０７…画素電極、２０９…ゲート、２１１…ソース、２１３…ドレイン

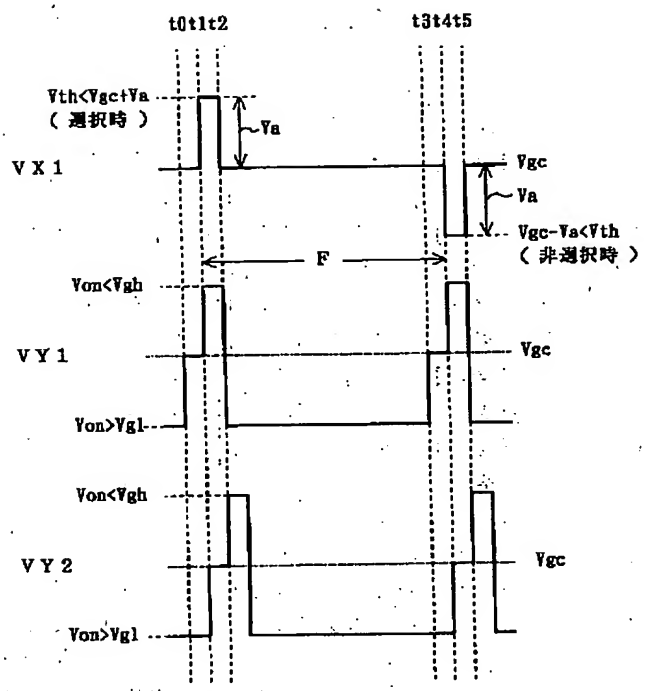
【図１】



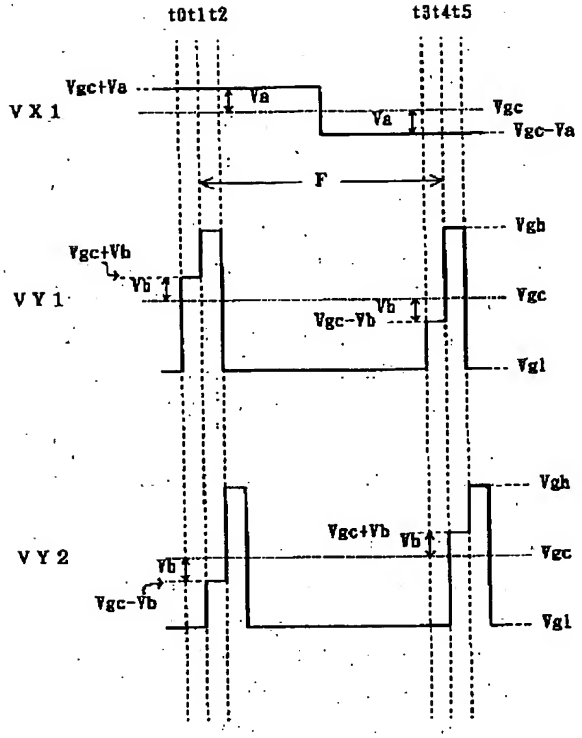
【図２】



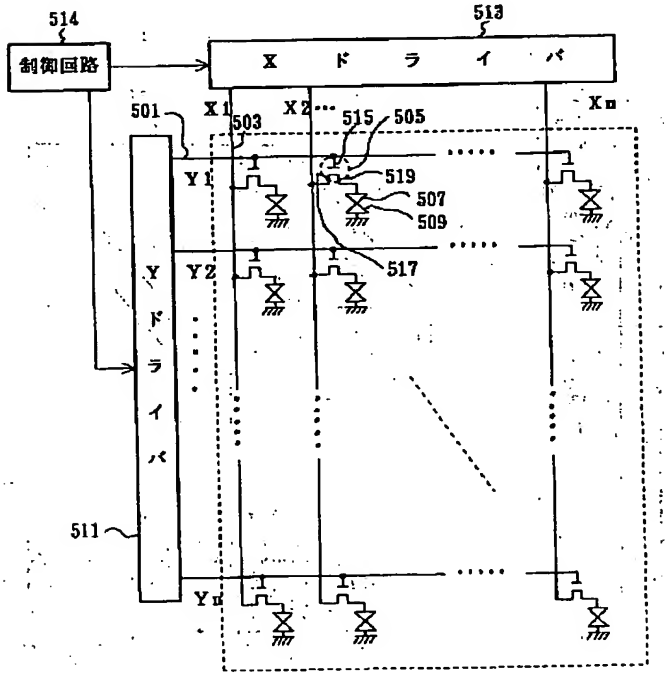
【図３】


t0t1t2
t3t4t5
Vth<Vgc+Va
（選択時）
Va
ＶＸ１
Vgc
Va
Vgc-Va<Vth
（非選択時）
F
Von<Vgh
ＶＹ１
Vgc
Von>Vgl
Von<Vgh
ＶＹ２
Vgc
Von>Vgl

【図４】


t0t1t2
t3t4t5
Vgc+Va
ＶＸ１
Va
Va
Vgc
Vgc-Va
F
Vgh
Vgc+Vb
Vb
ＶＹ１
Vgc
Vb
Vgc-Vb
Vgl
Vgh
Vgc+Vb
Vb
ＶＹ２
Vb
Vgc
Vgc-Vb
Vgl

【図５】


514
制御回路
513
Ｘ　ド　ラ　イ　バ
501
X1
X2
Xn
503
515
505
519
507
509
517
Y1
Y2
Ｙ　ドライバ
511
Yn